

ECONOMIC ANALYSIS OF SAFETY RISKS IN CONSTRUCTION

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Abstract:

The objective of this study revolves around the analysis of the safety risks involved with one construction project, and the respective economic effects of risk prevention and safety management. As a result of the co-ordination of systems, and harmonising of work between the Project Leader, Safety Co-ordinator and Contractor, an adequate strategy was developed for the safety of the project *Escola de Ciências da Saúde da Universidade do Minho*.

The *Escola de Ciências da Saúde da Universidade do Minho* project is situated in the centre of the city Braga. The area is destined to become a High Medical School,. The construction area covers around 30,000 m².

The management policy on Prevention, Hygiene and Safety is ensured by the following bodies with respective collaborations:

- General Safety Committee / Prevention and Safety Officer
- Co-ordination of on-site safety / General Safety Committee (from the point of view of Project Leader / Safety Co-ordinator).

The risk evaluation is carried out in simulated form, and task by task, introduced into the work programme. This gives a history of risk evaluation over the course of the project. The simulation allows peaks of risk to be identified, which will then lead to additional proposals of prevention measures. These prevention measures will serve to reduce risk and consequently lead to a curve on the risk chart. They consist not only of on-site measures, but also of the integrated implementation of working safety policies. We should be aware that risk can be reduced, but is difficult to eliminate altogether.

The implementation of prevention systems and working safety policies has its own cost, but what we intend to prove, by attributing costs to risks, is that safety has lower costs than a lack of safety.

Introduction:

The Safety and Health Coordination Staff of the *Escola de Ciências da Saúde da Universidade do Minho* Project, Braga, Portugal, in collaboration with the Civil Engineering Department of Minho University, has decided to make an economic study of risks, through its study during the work. This programme will be based on the detailed working programme, now approved.

The project programme required the foundations started on March 2005, and project completion by the October 2006, approximately one year and a half, in duration.

To each of the working programme activity is associated a risk evaluation dossier by the Safety Coordination, containing not only risks, but also preventive measures.

The evaluation of risks and choice between a preventive or non-preventive attitude leads to two different situations: the performance or inexistence of security during the work. This way, at the end we have two final risk histograms.

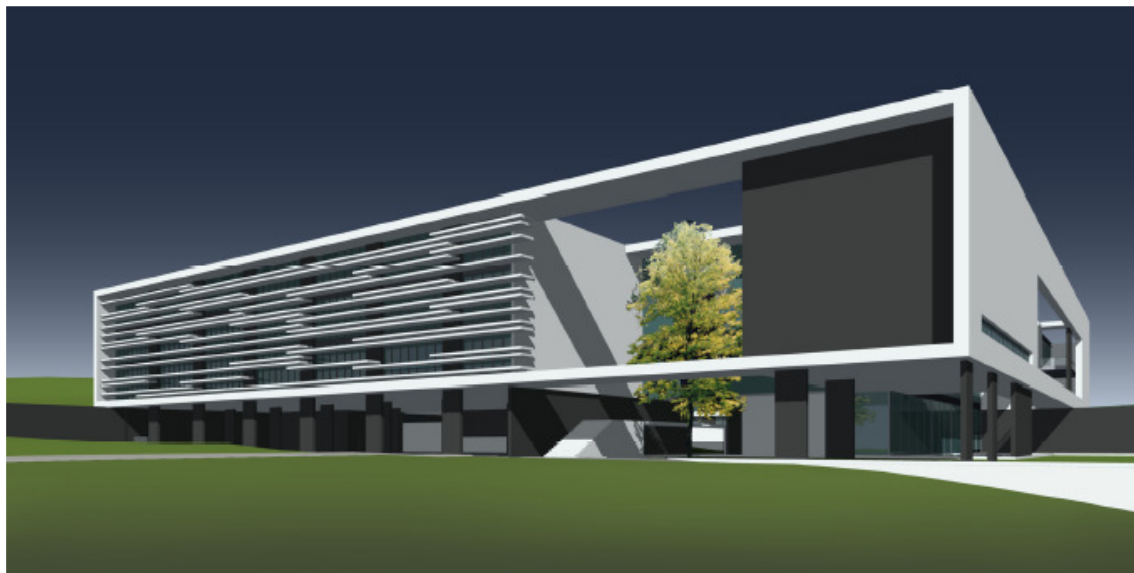


Figure 1 – Panoramic view of *Escola de Ciências da Saúde da Universidade do Minho*

Experimental:

Having a detailed working programme of *Escola de Ciências da Saúde da Universidade do Minho* Work as a basis, a study of total risks associated to the different activities concerned, has been done. Two simulations have been taken into consideration: one concerning the maximum risk evaluation, stressed by the inexistence of preventive measures on the works; the other fulfilling all possible preventive measures, however without eliminating all risks, as there will always be risks even if minimal.

The risk associated to the activities working programme of the correspondent work, with more than 1000 activities, is analysed in each of the activities after considering the information included in the Safety and Health Plan, in force in the work. The Safety and Health Plan contains Inspection and Prevention Procedures adaptable to the activities, related to the risks of each activity, as well as the preventive measures that can be implemented in the work, in order to minimise the correspondent risks.

So, it has been elaborated an inspection and prevention procedures table for each activity.

To optimise the use of that data, the procedures became part of the working programme activities.

For each Inspection and Prevention Procedure, i.e., for each activity, there are various risks associated. In the shipyard referred to this study, 82 types of risk were detected, with varying frequency. According to the computer program used, these risks are included in the resources of different activities.

In order to evaluate risks, an evaluation table was evolved, witch considers the severity and possibility of occurrence. The risk scale ranges from 1 to 5, taking into account that there is no 0 value risk, as there is always risk, even if minimal.

Taking into consideration the lack of prevention at the work, a maximum value for each risk has been defined, as in some cases it reached 5, for instance falls from height. Risk 1 was defined considering the full use of prevention, whichever the circumstance, as this is, as previously referred, the minimum risk value assumed.

After considering all those elements, the experimental phase follows, and it is time to insert in the "Primavera Project Planner", a project management computer program, all connected activities, as in the approved working plan, and all activities related to risks, as if it was an activity resource.

After that treatment, the simulation values of risk to both situations that will be simulated is added. One corresponds to total inexistence of prevention and the other to full prevention measures, and a study of both risk situations is done, having the histogram of the work plan related to working programme, as its basis.

Results:

According to the data inserted in the program, results are simulated for both situations. In the first situation, where risk analysis is maximised, taking into consideration the fact that there is

no prevention, there is a total result of 356.663 risk points, adding all risks related to the activities. In the second situation, assuming that there is full prevention of risks at all levels, the total of risk point is 92.354.

It should be noted that when prevention is not implemented the risk is 4 times greater than prevention is fully implemented.

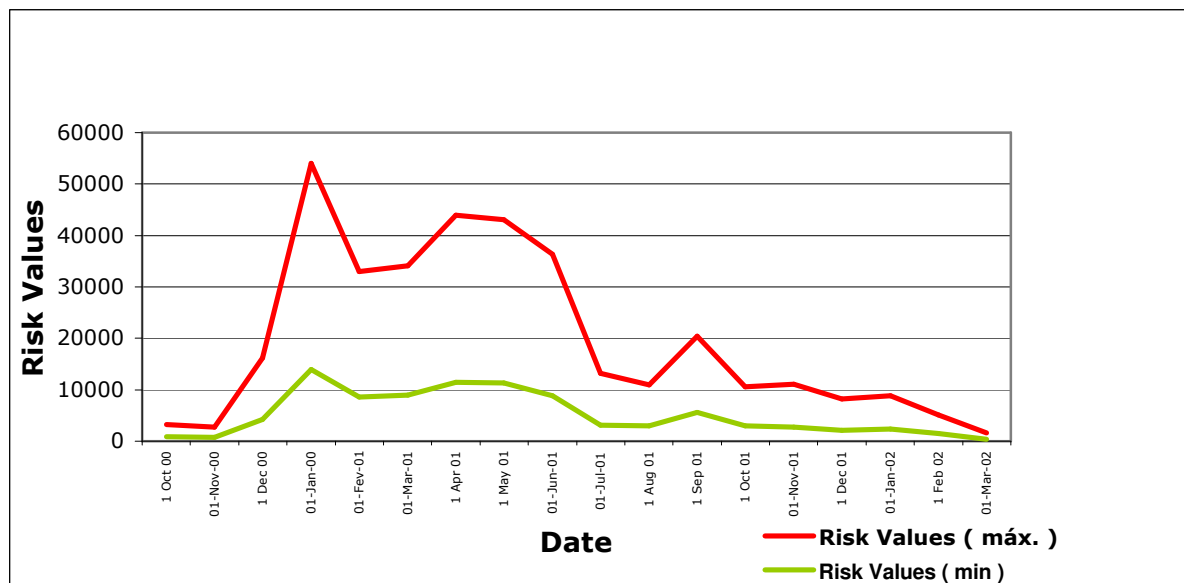


Table 1 – *Escola de Ciências da Saúde da Universidade do Minho* – Risk Values Monthly

Discussion:

Taking into consideration the 3.86 as the maximum average reference point, during the work, it is quickly noticed that in different phases, the difference of risk occurrence highly surpasses these values and so, apart from normal prevention situations, it is extremely important to act in "peak" risks. A parallel analysis can also be done, so as to evaluate the risks and costs, and to know "how much it costs to create safety".

Taking into consideration recent studies that show that safety costs for a similar work in Portugal rarely surpass 2%, it is possible to say that this percentage corresponds to the maximisation of risk prevention measures implemented in the work. This study shows that risk maximisation without prevention is 3.86 times larger, which also means that costs of safety can reach 7.72% of costs, i.e., 5.72% more than the costs of implementing safety measures.

Application of these values to the *Escola de Ciências da Saúde da Universidade do Minho*, with a project value of 15 millions of Euros, results in the following costs:

- Costs of implementation of prevention measures
(2,00%) ~ 0.30 millions Euros

- Potential costs of non-safety
(7.72%) ~ 1.16 millions Euros
- Potential risk of added costs due to the non-existence of prevention
(5.72%) ~ 0,86 million Euros

It is important to remember that the cost of non-safety are both quantifiable (fines, employees' salaries, lawyers, spoiled material, etc) and unquantifiable (work interruption, reduced of productivity, boarder of directors' time marginalised, company image, prestige, etc) the latter ones are no included in this study.

Conclusion:

This study applied, indicates that it is beneficial to invest in prevention. Apart from the need to minimise task risks, through the inclusion of safety measures in the Inspection and Prevention Procedures for tasks, there are other measures which can be implemented to realise even more benefits:

- Coordination Meetings with all contributors.
- Safety Working Commission Meetings.
- Training, counselling, and informing of all workers and managers.
- Discussing of the Safety and Health Plan with all participants from all working sectors, throughout the project.
- Planning all activities in order to assure the implementation of safety measures in future work.

All these measures are solutions that approximate safety costs from values practised, by those that care about prevention, and risk minimisation.

It is, therefore, logical to state the aphorism "Decreasing risks means decreasing work costs".

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